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(54) Wiping sheet of raised non-woven fabric and production thereof

(57) The present invention provides a wiping sheet produced from a sheet stock of at least one non-woven fabric such that a surface of the sheet stock is raised by partial cutting and loosening of fibers as it undergoes mechanical resistance. The wiping sheet is highly effective for both dry wiping and wet wiping, is bulky and has a good texture (i.e., soft touch).

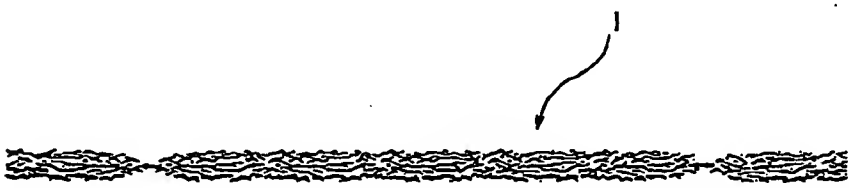

Fig. 1(A)

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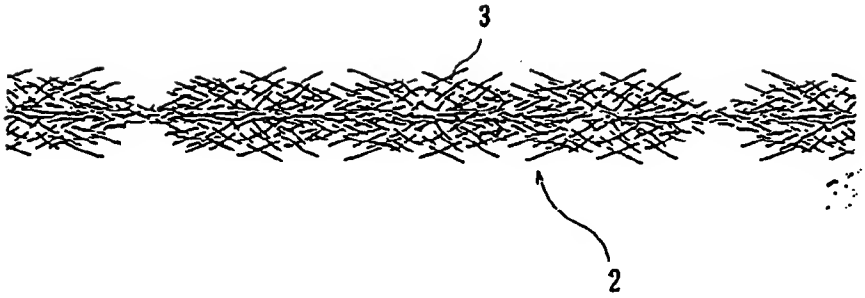


Fig. 1(B)

Description

[0001] The present invention relates to a wiping sheet of raised, non-woven fabric, a process for producing the same, and the lik..

[0002] Throwaway or disposable wiping sheets of non-woven fabric have been widely used, such as to remove makeup, to clean the perianal of a baby, to clean the floor or toilet, and the like. A soft texture is required when used as a dry or wet tissue, such as for removing makeup or cleaning the perianal region because they come into direct contact with human skin, e.g., the hands. Further, a good wiping effect, a sufficient stiffness and an ability to be used for both dry wiping and wet wiping are required of them if they are to sweep the floor, toilet or the like. Japanese Patent Application No. 245090/1993 discloses a cleaning article of non-woven fabric which has an irregular surface and is impregnated with an oil-based agent. However, this cleaning article cannot be used for wet wiping because it contains an oil-based agent to attract dust. To solve this problem, the present inventors disclosed, in Japanese Patent Application No. 68728/1997, a wiping sheet having a multi-layer structure which can be used for both dry wiping and wet wiping. However, this wiping sheet is less effective in capturing fine dust particles during dry wiping, although it is somewhat more effective during wet wiping.

[0003] It is an object of the present invention to provide a wiping sheet which is bulky and has a soft texture and feel.

[0004] It is another object of the present invention to provide a process for producing the wiping sheet of the invention.

[0005] It is still another object of the present invention to provide a wiping sheet that is effective during both dry wiping and wet wiping, and is highly effective for capturing fine dust particles during dry wiping.

[0006] The wiping sheet of the present invention is produced from a sheet stock of at least one non-woven fabric in such a way that the surface of the sheet stock is raised by partial cutting and loosening of fibers as it undergo s mechanical resistance.

[0007] The sheet stock can be a single-layer structure or multi-layer structure. For example, in the former, it can b composed of one piece of spun lace non-woven fabric, while in the latter, it can be composed of two pieces of spun lace non-woven fabrics and one piece of non-woven fabric that is not spun lace interposed between them, with the spun lace non-woven fabrics raised at both sides of the sheet stock.

[0008] In the case where the sheet stock is composed of a single spun lace non-woven fabric, it is preferable that at least one fiber has a raised height of 0.4 mm or more, per 1.6×10^{-5} cm^2 of the sheet surface. Moreover, it is also preferable that the spun lace non-woven fabric contains hydrophobic fibers and at least one fiber selected from absorbent fibers and hydrophilic fibers. In addition, it is preferable that the spun lace non-woven fabric is raised at both sides thereof.

[0009] If the sheet stock is a multi-layer structure, it is preferable that at least one fiber has a raised height of 0.4 mm or more per 1.6×10^{-5} cm^2 of the sheet surface. Moreover, it is also preferable that all of the non-woven fabrics contain hydrophobic fibers and at least one fiber selected from absorbent fibers and hydrophilic fibers. In addition, it is preferable that the content of hydrophobic fibers in the spun lace non-woven fabric is greater in an upper layer than in an lower layer, and the content of absorbent fibers and hydrophilic fibers in the spun lace non-woven fabric is greater in the lower layer than in the upper layer. It is preferable that all the non-woven fabrics contain a thermoplastic resin which are fusion-bonded together along bonding lines.

[0010] According to the present invention, the wiping sheet is produced by subjecting a surface of a sheet stock composed of at least one piece of non-woven fabric to mechanical resistance by needles or a bar in such a way that fibers are raised by partial cutting and loosening.

[0011] Embodiments of the invention are described below with reference to the accompanying drawings, in which:

[0012] **Fig.1(A)** is an enlarged side sectional view of a portion of sheet stock which is not yet raised.

[0013] **Fig. 1(B)** is an enlarged side sectional view of a portion of wiping sheet of the present invention produced by raising the sheet stock shown in **Fig. 1(A)**.

[0014] **Fig. 2(A)** is a schematic diagram showing an example of the process for producing the wiping sheet of the present invention.

[0015] **Fig. 2(B)** is a schematic diagram of a typical pile roller and a counter pile roller as shown in **Fig. 2(A)**.

[0016] **Fig. 3** is a diagrammatic side elevation of another example of the process for producing the wiping sheet of the present invention.

[0017] Fig. 4 is an enlarged sectional elevation showing the side by side relationship of a portion of sheet stock which is not yet raised and the wiping sheet of the present invention which was obtained by raising the sheet stock.

[0018] **Fig. 5** is a sectional elevation of the individual lay rs of sheet stock which form the wiping sheet of the present invention.

[0019] **Fig. 6** is a plan view of the wiping sheet shown in **Fig. 5.**

[0020] **Fig. 7** is a diagrammatic perspective view of the wiping sheet attached to a cleaning mop.

[0021] **Fig. 8** is a graph showing the results of the test for dry wiping in the Examples.

[0022] **Fig. 9** is a graph showing th results of the test for wet wiping in the Examples.

[0023] The invention is described in more detail with reference to the accompanying drawings.

[0024] As used herein, the term "raised height" means that at least on fiber is raised to th specified height or more per 1.6 x 10^{-5} cm^2 of the sheet surface.

[0025] As used herein, "comprises" and all its grammatical forms specifies the presence of stated features, integers, steps or components, but dose not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

[0026] **Fig. 1(A)** is an enlarged side sectional view of a portion of sheet stock which is not yet raised. **Fig. 1(B)** is an enlarged side sectional view of the wiping sheet of the present invention produced by raising the sheet stock shown in **Fig. 1(A)**.

[0027] A sheet stock **1** shown in **Fig. 1(A)** is composed of a single spun lace non-woven fabric formed from a fiber web, with the fibers interlaced by water jets. It is noted that the sheet stock **1**, which is not yet raised as shown in **Fig. 1(A)**, has a slightly fluffy surface with its fibers projecting therefrom; however, the degree of projecting (the number and height of the projecting fibers) is very small. According to the present invention, the surface of the sheet stock **1** undergoes mechanical resistance so that fibers are partially cut and loosened. The resulting sheet stock **1** has raised surfaces with an enormous number of projected fibers. (The sheet stock **1** which has undergone mechanical resistance for raising is hereinafter referred to as a raised sheet **2**.) As shown in **Fig. 1(B)**, the raised sheet **2** is much thicker and bulkier than the sheet stock **1**.

[0028] In **Fig. 1(A)**, the spun lace non-woven fabric is illustrated as the sheet stock **1** which is to be raised. Although the sheet stock **1** may be composed of any other non-woven fabric, e.g., spun bond non-woven fabric, melt-blown non-woven fabric, needle punch non-woven fabric, stitch bond non-woven fabric, dry non-woven fabric and wet non-woven fabric, the spun lace non-woven fabric is preferred for use as the sheet stock **1** because it permits the surface fibers to be raised easily when the fabric undergoes mechanical resistance.

[0029] The sheet stock **1** may be composed of a single non-woven fabric manufactured to have a double-lay r structure or may have a multi-layer structure where two or more pieces of non-woven fabrics are laminated. In the case where the sheet stock **1** has the multi-layer structure, it is preferred that outer layers which appear on the surfaces of the sheet stock **1** are spun lace non-woven fabrics for easy raising.

[0030] To raise the fibers, the surfaces of the sheet stock **1** undergo mechanical resistance which cuts and loosens fibers properly. This is practically accomplished by scratching the fibers with needles or rubbing the sheet stock **1** against a bar.

[0031] An example of the methods for producing the raised sheet **2** by using needles is shown in **Figs. 2(A)** and **2 (B)**. This method is designed to easily carry out raising to any degree desired, by rotating rollers in contact with the surface of the sheet stock **1**, said rollers having a large number of needles thereon. As shown in **Fig. 2(A)**, the sheet stock **1** is held between drive rollers **9a** and pinch rollers **9b**, and travels in the direction of arrow **6** in circulation. As shown in **Fig. 2(B)**, the surface of the sheet stock **1** comes into contact with a pile roller (PR) **5**, which turns in the direction of arrow **8** (the same as arrow **6**), and then comes into contact with a counter pile roller (CPR) **4**, which turns in the direction of arrow **7** (the same as arrow **6**). This process is repeated two times, as shown in **Fig. 2(A)**. The raising of sheet stock **1** in this way permits the production of the raised sheet **2**, having surfaces that are raised adequately.

[0032] The counter pile roller **4** and the pile roller **5** have a large number of needles on their surface, as shown in **Fig. 2(B)**. These needles have hooked tips. The needle tips of the counter pile roller **4** project in the direction opposite arrow **7**, whereas the needle tips of the pile roller **5** project in the same direction as arrow **8**. As these rollers turn on the surface of the sheet stock **1**, their needles catch fibers, thereby cutting or loosening the caught fibers, in order to raise the fibers.

[0033] The degree of raising may be controlled by the difference between a velocity V (at which the sheet stock **1** travels and the drive roller turns at the same peripheral velocity) and a peripheral velocity V_{CPR} (at which the counter pile roller **4** turns), and by the difference between the velocity V and a peripheral velocity V_{PR} (at which the pile roller **5** turns). For example, the differences between the velocities are so set that the peripheral velocity V_{CPR} is less than the velocity V while the peripheral velocity V_{PR} is more than the velocity V. The degree of raising can also be controlled by varying the number and shape of needles on the roller surface.

[0034] Although raising can be accomplished efficiently and effectively by using two kinds of rollers (the counter pile rollers **4** and the pile rollers **5**), raising can also be accomplished by using only one kind of roller. Further, raising can be accomplished by using stationary needles which are fixed along the way where the sheet stock 1 travels, instead of using the rollers having needles thereon.

[0035] Another example of the methods for producing the raised sheet **2** is shown in **Fig. 3**. According to this method, the sheet stock **1** is fed in the dir ction of arrow **6** in such a way that it is supported by two rolls **10** and it und rgoes resistanc by a bar **11**. The bar **11** is made of a hard substance such as stainless ste l. Due to r sistance against the bar **11**, the fibers of the sheet stock **1** are cut and loosened to produce the raised sheet **2**.

[0036] The raised sheet **2**, produced from the sheet stock **1** as described above, is used as th wiping sheet of the present invention. The raised fibers **3** formed by mechanical resistance on the surface of the non-woven fabric form

larg spaces b tween them. Therefore, th wiping sheet captures fin dust in these spaces. Even in dry wiping, the wiping sheet of the invention is more effective than a conventional wiping sheet formed from a non-woven fabric without raising by mechanical resistance. In other words, the raising of fibers produces marked improvement in the wiping effect during dry wiping, without an oil-based agent impregnated therein. In addition, the raised sheet **2** is soft to the touch.

[0037] Fig. **4** is an enlarged sectional elevation showing the sheet stock **1** and the raised sheet **2** (wiping sheet) side by side for comparison. In an example shown in Fig. **4**, the sheet stock **1** is composed of a single spun lace non-woven fabric.

[0038] In order to obtain a wiping sheet having excellent dry-wiping properties, bulkiness and texture (softness) it is preferred that at least one fiber has a raised height of 0.4 mm per 1.6×10^{-5} cm^2 of the sheet surface. More preferably, at least one fiber has a raised height of 0.6 mm per 1.6×10^{-5} cm^2 of the sheet surface. Raising to such an extent is obtained when the surface of an ordinarily produced non-woven fabric undergoes mechanical resistance. The height of a fiber (not the total length of a fiber is measured from the surface of the sheet stock **1** which is not yet raised. Incidentally, as shown in Fig. **4**, individual raised fibers **3** can differ in the raised height.

[0039] The average raised height is preferably 0.4 mm or more, more preferably 0.6 mm or more. The average raised height is defined by the thickness of the region "h" which has the raised fibers **3** at a sufficient consistency to form a substantially unified raised layer. If the region "h" has no clear upper boundary, it is possible to obtain the average raised height from the difference between the thickness of the sheet stock **1** (not yet raised) and the thickness of the raised sheet **2** (wiping sheet) that has been placed on the floor with raised fibers facing downward and pressed under its own weight.

[0040] It is apparent from Fig. **4** that raising takes place mainly in the region near the surface of the sheet stock **1**, such that fibers close to the center of the sheet stock **1** remain almost unchanged. Raising in this manner helps the raised sheet **2** (wiping sheet) to maintain its strength, even after raising.

[0041] As explained above, the wiping sheet shown in Fig. **4**, which is produced from a single spun lace non-woven fabric, has good wiping properties with respect to capturing fine dust particles, bulkiness and texture (soft to the touch), while it maintains strength. Therefore, it is suitable for use as sheet (in the form of a dry or wet tissue) such as, for example, to remove makeup or to clean the perianal region of an infant. It is preferable that the spun lace non-woven fabric, which is used as the sheet stock **1** contains hydrophobic fibers and at least one type of fiber selected from absorbent fibers and hydrophilic fibers so that the wiping sheet slides easily across the object to be cleaned and can retain sufficient water for wet wiping.

[0042] As mentioned above, the wiping sheet of the present invention can be produced by raising the sheet stock **1** of a multi-layer structure, which is composed of two or more pieces of non-woven fabrics. This multi-layer sheet stock **1** is preferably composed of two pieces of spun lace non-woven fabrics as outer layers, and at least one piece of non-woven fabric other than spun lace non-woven fabric as a middle layer interposed between the outer layers. Examples of the middle layer include air-through bond non-woven fabric, spun bond non-woven fabric and point bond non-woven fabric. A wiping sheet of the invention has an adequate stiffness and thickness (for good handling) by using any one or a combination of the through-air bond non-woven fabric (in which fibers are fusion-bonded by hot air) and the spun bond non-woven fabric and the point bond non-woven fabric (in which fibers are partly fusion-bonded). Therefore, the wiping sheet made from the multi-layer sheet stock **1** is suitable for use as a cleaning sheet on hard surfaces, such as for a floor or a toilet.

[0043] If the wiping sheet of the invention is designed for wiping using only one surface, the multi-layer sheet stock **1** can have one piece of spun lace non-woven fabric for raising.

[0044] Even in the case where the wiping sheet is formed by using the multi-layer sheet stock **1**, it is also preferred that at least one fiber has a raised height of 0.4 mm or more per 1.6×10^{-5} cm^2 of the sheet surface. More preferably, at least one fiber has a raised height of 0.6 mm or more per 1.6×10^{-5} cm^2 of the sheet surface. Further, the average raised height is also preferably 0.4 mm or more, more preferably 0.6 mm or more.

[0045] Fig. **5** is a sectional view showing the wiping sheet formed from the multi-layer sheet stock **1**, with individual layers separated.

[0046] Fig. **5** shows the sheet stock **1** having a three-layer structure consisting of two pieces of spun lace non-woven fabrics **12** as outer layers, and one piece of non-woven fabric **13** (such as of air-through bond non-woven fabric, spun bond non-woven fabric or point bond non-woven fabric) as a middle layer interposed between the outer layers. The three-layer sheet stock **1** is raised at the outer layers (of the spun lace non-woven fabrics **12**) so that the wiping sheet permits cleaning with both surfaces.

[0047] In this mbodiment, it is preferable that the spun lace non-woven fabrics **12** constituting the outer layer contain hydrophobic fibers so that the wiping sheet slides easily across a floor (or any surfac to be cleaned) at the time of both dry wiping and wet wiping. It is also preferable that the spun lace non-woven fabric **12** contains at least one fiber selected from absorbent fibers and hydrophilic fibers so that the wiping sheet retains an adequate amount of water at the time of wet wiping. The content of hydrophobic fibers in the spun lace non-woven fabric **12** should preferably be 5

wt % or more of the fabric so that absorbed water will not flow out from the non-woven fabric **13** constituting the middle layer.

[0048] Further, the spun lace non-woven fabric **12** may be formed from two fiber webs (e.g., joined together by applying water jets) to have an upper layer for raising and a lower layer for facing the non-woven fabric **13.** In this embodiment, it is preferred that the content of hydrophobic fibers in the upper layer (for raising) is greater than the content of hydrophobic fibers in the lower layer (for facing the non-woven fabric **13**), and the content of absorbent fibers and hydrophilic fibers in the lower layer is greater than in the upper layer, so that the wiping sheet slides easily across a surface and retains an adequate amount of water while preventing the back flow of water.

[0049] The non-woven fabric **13** as the middle layer preferably contains hydrophobic fibers which impart stiffness to the wiping sheet. It is also preferred that the non-woven fabric **13** contains at least one fiber type selected from absorbent fibers and hydrophilic fibers so that the non-woven fabric **13** retains water when the wiping sheet is used for wet wiping.

[0050] Examples of the hydrophobic fibers contained in the spun lace non-woven fabric **12** and the non-woven fabric **13** include polypropylene (PP) fibers, polyethylene (PE) fibers, polyethylene terephthalate (PET) fibers and acrylic fibers. Because these fibers are thermoplastic, the spun lace non-woven fabric **12** and the non-woven fabric **13** can be fusion-bonded to each other. In view of this, more preferably, the non-woven fabric **12** and **13** contain fibers such as of low-melting PET to facilitate fusion-bonding.

[0051] Examples of the hydrophilic fibers include sweat-absorbing polypropylene (PP) fibers, sweat-absorbing polyethylene (PE) fibers, and sweat-absorbing polyester (PET) fibers, which are, for example, PP, PE, PET fibers coated or incorporated with a hydrophilic surface active agent.

[0052] Examples of the absorbent fibers include rayon fibers, cellulose fibers and nylon fibers. However, other fibers can be used so long as they possess similar water retention and absorption properties of those listed.

[0053] The effect of the hydrophobic synthetic fibers and absorbent fibers and/or the hydrophilic fibers contained in the wiping sheet is that the former prevents the back flow of water while the latter retains water. Thus, the wiping sheet can clean a large area while maintaining a wet state without excess water on its surface.

[0054] It is preferred that the non-woven fabric **13** has a basis weight of 25 to 55 g/m^2, so that the wiping sheet has an adequate degree of flexibility and stiffness to permit repeated use.

[0055] **Fig. 6** is a top plan view of the wiping sheet shown in **Fig. 5.** This wiping sheet is composed of two pieces of spun lace non-woven fabrics **12** and one piece of non-woven fabric **13,** each containing a thermoplastic resin (thermoplastic fibers as mentioned above), which fabrics are bonded together along bonding lines **14** by heating.

[0056] To produce a wiping sheet of the present invention, the spun lace non-woven fabrics **12** overlay the non-woven fabric **13** to form the three-layer structure shown in **Fig. 5.** Then, these non-woven fabrics **12** and **13** are pressed between heat embossing rolls having a wavy pattern thereon, or between a heat embossing roll having a wavy pattern thereon and a heat roll having a flat surface. This process melts the thermoplastic resin contained in the non-woven fabrics **12** and **13,** achieving their fusion-bonding along the bonding lines **14.** The resulting product is the three-layer sheet stock **1,** which subsequently undergoes raising.

[0057] The bonding lines **14** are not specifically restricted in shape. However, if the bonding lines **14** are formed in a wavy pattern, e.g., herringbone pattern, sawtooth pattern, or the like, they have good wiping properties due to the surface irregularities.

[0058] The above-mentioned heat-embossing step is not the only way to bond together the non-woven fabrics **12** and **13.** The object may also be achieved by ultrasonic heating, or by coating an adhesive such as a hot-melt adhesive between abutting faces of the non-woven fabrics **12** and **13** followed by pressing with pressure embossing rolls.

[0059] The multi-layer sheet stock **1** thus produced yields a wiping sheet which has sufficient stiffness in its dry state as well as in its wet state, such as when impregnated with water or chemical solution. This sufficiently stiff wiping sheet does not get twisted or wrinkled easily during its use even though it is not folded. In addition, it readily restores to its original shape after it is squeezed as in the case of a cloth duster. Therefore, it can be used repeatedly after washing with water.

[0060] In the above-mentioned process, the bonding of the spun lace non-woven fabrics **12** and the non-woven fabric **13** is accomplished prior to raising the fibers. However, the order of these steps may be reversed. In this embodiment, raising is performed on one side of each spun lace non-woven fabric **12** and then bonding is accomplished, with the non-woven fabric **13** interposed between the raised spun lace non-woven fabrics **12.**

[0061] The wiping sheet of the present invention can be used by holding in hand or by attaching it to a commercial cleaning tool, such as a cleaning mop M as shown in **Fig. 7.** To facilitate the attachment of the wiping sheet to the cleaning mop M, the wiping sheet is preferably softened at both side portions to be clamped by holders of the cleaning mop M, so as to reduce the stiffness at the side portions, compared with a central portion between the side portions. This softening can be accomplished by embossing. The resulting wiping sheet maintains a sufficient stiffness as a whole, while it can be readily attached to the cleaning mop M.

[0062] In order to enhance the wiping properties of the wiping sheet of the present invention, a large number of openings can be included in the surface of the wiping sheet by using needles or water jets. The openings may be round

or oval and can vary in diameter from 1 to 5 mm.

[0063] To further illustrate the invention, and not by way of limitation, the following examples are provided.

EXAMPLES

[0064] A spun lace non-woven fabric was prepared from the following fibers to provide an outer layer of the wiping sheet of the present invention:

Rayon fibers	1.5 denier, 38 mm long, 50 wt%
Sweat-absorbing PET fibers	1.5 denier, 44 mm long, 35 wt%
Low-melting PET fibers	2.0 denier, 51 mm long, 15 wt%

[0065] An air through bond non-woven fabric was prepared from the following fibers to provide a middle layer between the spun lace non-woven fabrics:

Rayon fibers	2.0 denier, 51 mm long, 45 wt%
Low-melting PET fibers	2.0 denier, 51 mm long, 40 wt%
Hollow PET fibers	2.0 denier, 51 mm long, 15 wt%

[0066] Two pieces of the spun lace non-woven fabrics and one piece of the air through bond non-woven fabric interposed between them were bonded together under the following conditions to give a multi-layer sheet stock:

[0067] Embossing between an upper roll with a herring bone pattern and a lower flat metal roll.

Temperature: 130ºC (upper roll) and 135ºC (lower roll)
Pressure: 50 kg/cm^2
Bonding speed: 6 m/min

[0068] After bonding, fibers of the resulting multi-layer sheet stock were raised under the following conditions to produce a wiping sheet of the present invention:

V_{PR} (pile roller 5) = 99.7 rpm
V_{CPR} (counter pile roller 4) = 99.5 rpm
V_{CAP} (capstan roll or drive roll **9a**) = 99.8 rpm

[0069] This step was accomplished by using a needle-type raising machine as schematically shown in **Figs. 2(A)** and **2(B)**, which is available from Kanai Juryou Kogyo Co., Ltd. In each raising cycle, the multi-layer sheet stock was subjected to raising by two pile rollers and two counter pile rollers, as shown in **Fig. 2(A)**. This raising cycle was repeated 5 times, 20 times and 30 times for Example 1, Example 2 and Example 3, respectively. The height after raising (raised height) was 0.4 mm, 0.6 mm and 1.2 mm in Example 1, Example 2 and Example 3, respectively.

[0070] The wiping sheets of Examples 1-3 were tested for dry wiping and wet wiping as follows.

Test for dry wiping

[0071] Breaderumbs (0.5 g) were uniformly spread over a floor (100 by 50 cm). The surface of the floor was swept once using the wiping sheet, which was attached to a commercial cleaning mop. The wiping sheet was detached from the mop carefully and weighed. The amount (g) of breadcrumbs collected was calculated by subtracting the weight of the wiping sheet before sweeping from the weight of the wiping sheet after sweeping.

[0072] In comparative Example 4, the same test for dry wiping, as described above, was performed by using a commercial cleaning sheet for mopping which is a PET non-woven fabric sprayed with 5 wt% oil-based agent (mineral oil) to the weight of the PET non-woven fabric.

[0073] In comparative Example 5, the same test for dry wiping as described above was performed by using a wiping sheet which has the same structure as the wiping sheets described in Examples 1-3, but is not raised. The test results are shown in **Fig. 8.**

Test for wet wiping

[0074] After soaking with water (2.5 times its own weight), the five wiping sheets, prepared as described above, were

tested for wet wiping in the same manner as for dry wiping. The comm rcial cleaning sheet in comparative Example 4 was incapable of wet wiping because of the oil-based agent contained therein. Th test results are shown in **Fig. 9.**

[0075] It is apparent from **Figs. 8** and **9** that the wiping sheets described in Examples 1-3 are highly effective for both dry wiping and wet wiping, and that the wiping sheet having fibers raised higher than 0.6 mm was extremely effective.

[0076] While in the foregoing specification the present invention has been described in relation to preferred embodiments and many details have been set forth for purpose of illustration, it should be apparent to those skilled in the art that the present invention is susceptible to additional embodiments, and that certain details described herein can be varied considerably without departing from the basic principles of the present invention.

Claims

1. A wiping sheet product, made by the process of raising a sheet stock by partial cutting and loosening of fibers while subjecting the sheet stock to mechanical resistance wherein the sheet stock comprises at least one piece of non-woven fabric.

2. The wiping sheet of claim 1, wherein:
the sheet stock comprises spun lace non-woven fabric.

3. The wiping sheet of claim 2, wherein:
at least one fiber has a raised height of 0.4 mm or more per 1.6×10^{-5} cm^2 of the sheet surface.

4. The wiping sheet of claim 2, wherein:
the spun lace non-woven fabric comprises hydrophobic fibers and at least one fiber selected from absorbent fibers and hydrophilic fibers.

5. The wiping sheet of claim 2, wherein:
the spun lace non-woven fabric is raised at both sides of the sheet stock.

6. The wiping sheet of claim 1, wherein:
the sheet stock has a multi-layered structure comprising two pieces of spun lace non-woven fabric and at least one piece of non-woven fabric which is not spun lace interposed between the spun lace non-woven fabrics, wherein the spun lace non-woven fabrics are raised at both sides of the sheet stock.

7. The wiping sheet of claim 6, wherein:
at least one fiber has a raised height of at least 0.4 mm per 1.6×10^{-5} cm^2 of the sheet surface.

8. The wiping sheet of claim 7, wherein:
all the non-woven fabrics contain hydrophobic fibers and at least one fiber selected from absorbent fibers and hydrophilic fibers.

9. The wiping sheet of claim 8, wherein:
the content of hydrophobic fibers in the spun lace non-woven fabric is higher in an upper layer thereof than in a lower layer thereof, and the content of absorbent fibers and hydrophilic fibers in the spun lace non-woven fabric is higher in the lower layer than in the upper layer.

10. The wiping sheet of claim 8, wherein:
all the non-woven fabrics contain a thermoplastic resin and are fusion-bonded together along bonding lines.

11. A process for producing a wiping sheet which comprises subjecting a surface of a sheet stock comprised of at least one piece of non-woven fabric to mechanical resistance by needles to raise fibers by partial cutting and loosening.

12. The process for producing a wiping sheet of claim 11, wherein:
the sh t stock comprises one piece of spun lace non-wov n fabric.

13. The process for producing a wiping sheet of claim 11, wherein:

the sheet stock has a multi-layer d structure comprising two piec s of spun lace non-woven fabric and at least one piece of non-woven fabric which is not spun lace interposed between the spun lace non-woven fabrics, and the raising is accomplished by subjecting the spun lace non-woven fabrics to mechanical resistance at both sides of the sheet stock.

14. A process for producing a wiping sheet which comprises subjecting a surface of a sheet stock comprising at least one piece of non-woven fabric to mechanical resistance by a bar to raise the fibers by partial cutting and loosening.

15. The process for producing a wiping sheet of claim 14, wherein:
the sheet stock comprises one piece of spun lace non-woven fabric.

16. The process for producing a wiping sheet of claim 14, wherein:
the sheet stock has a multi-layered structure comprising two pieces of spun lace non-woven fabric and at least one piece of non-woven fabric which is not spun lace interposed between the spun lace non-woven fabrics, and the raising is accomplished by subjecting the spun lace non-woven fabrics to mechanical resistance at both sides of the sheet stock.

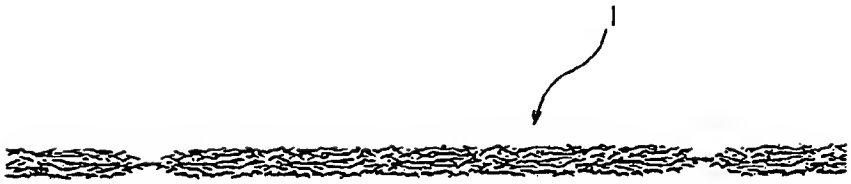


Fig. 1(A)

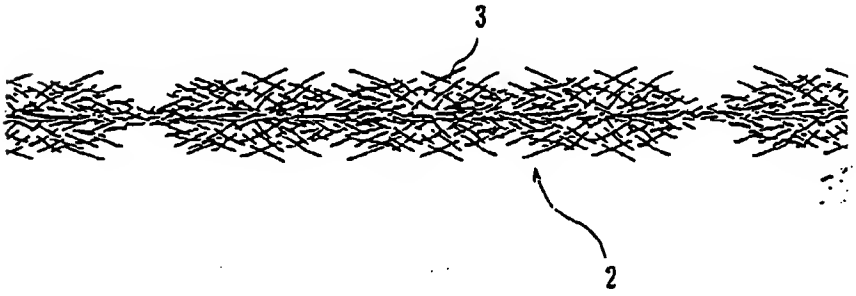
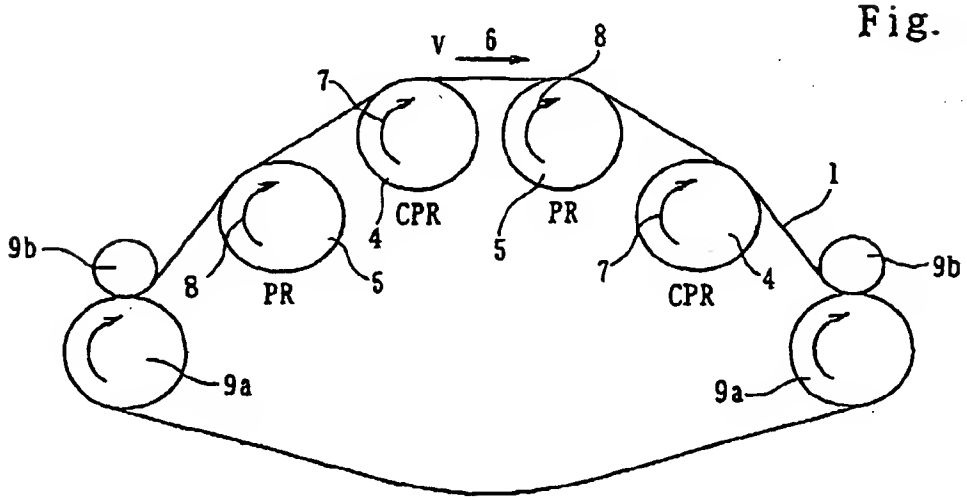


Fig. 1(B)

Fig. 2(A)



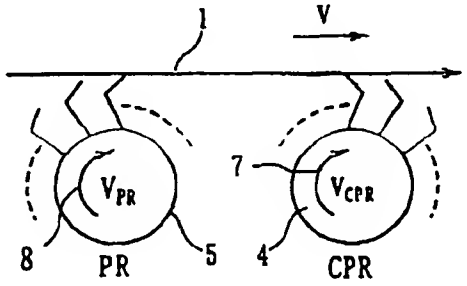


Fig. 2(B)

Fig. 3

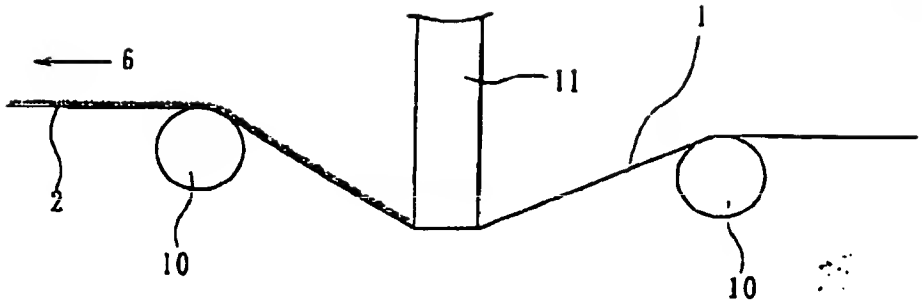


Fig. 4

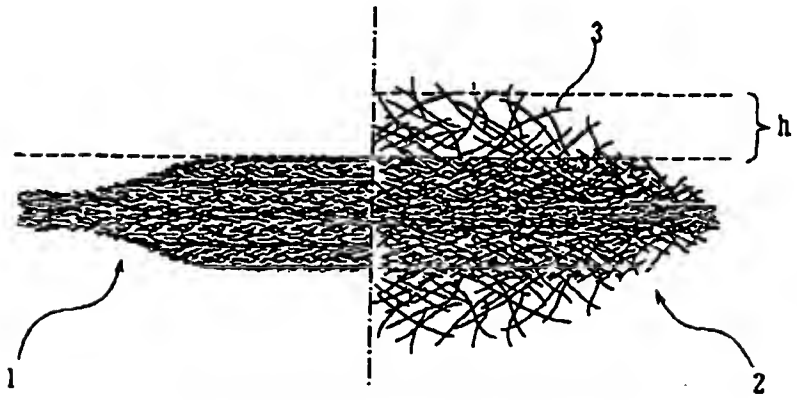


Fig. 5

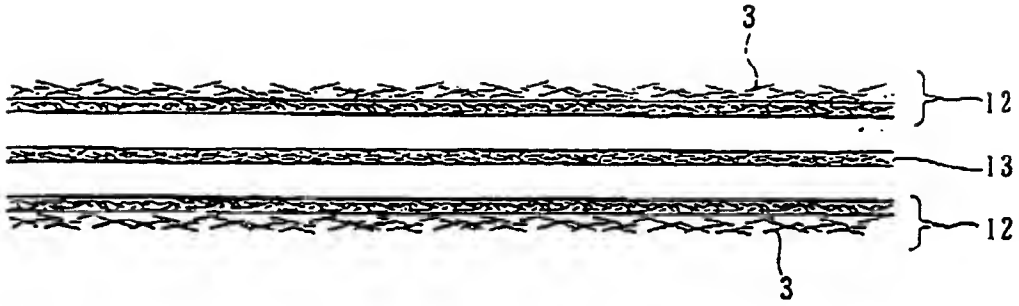
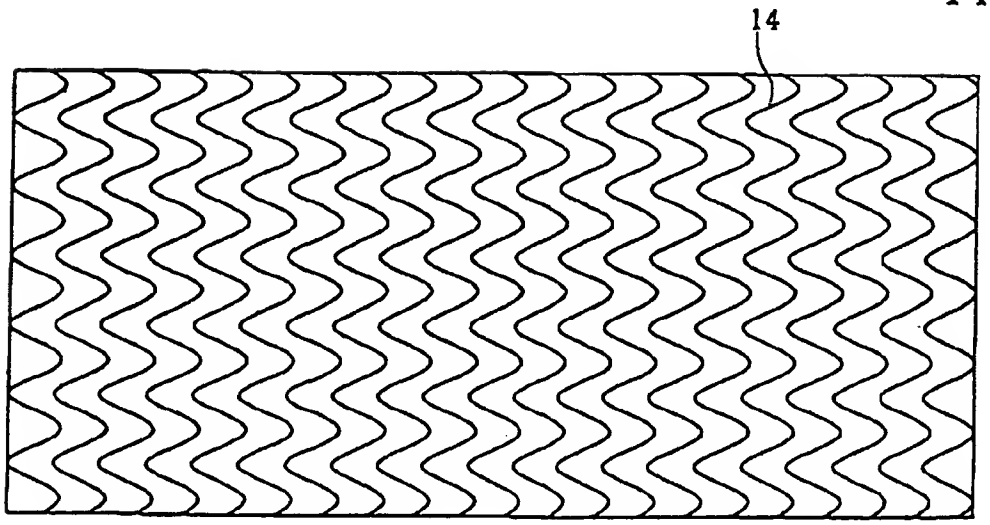


Fig. 6



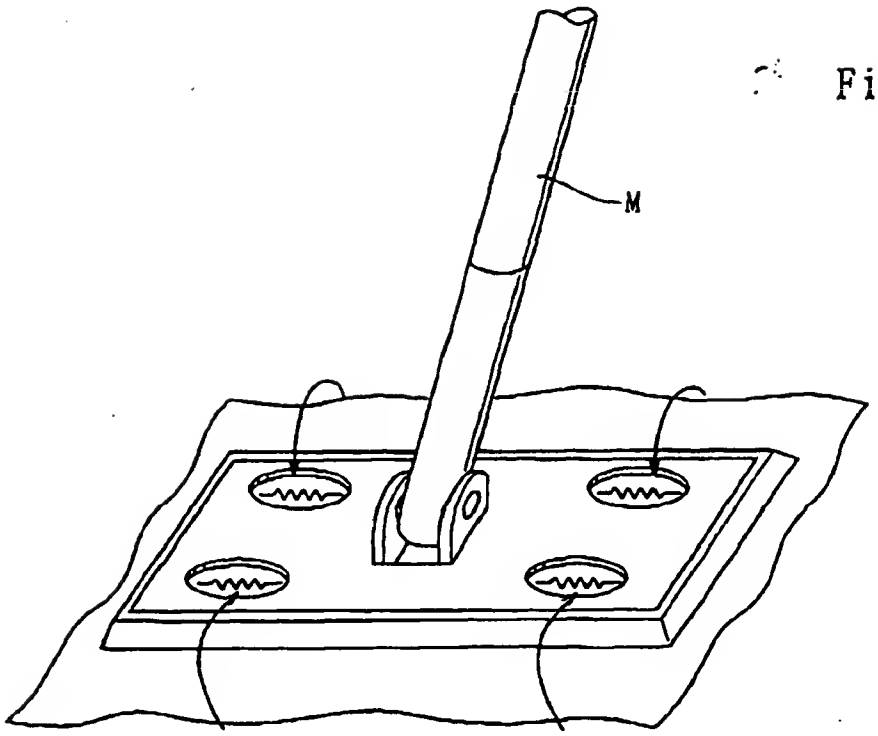
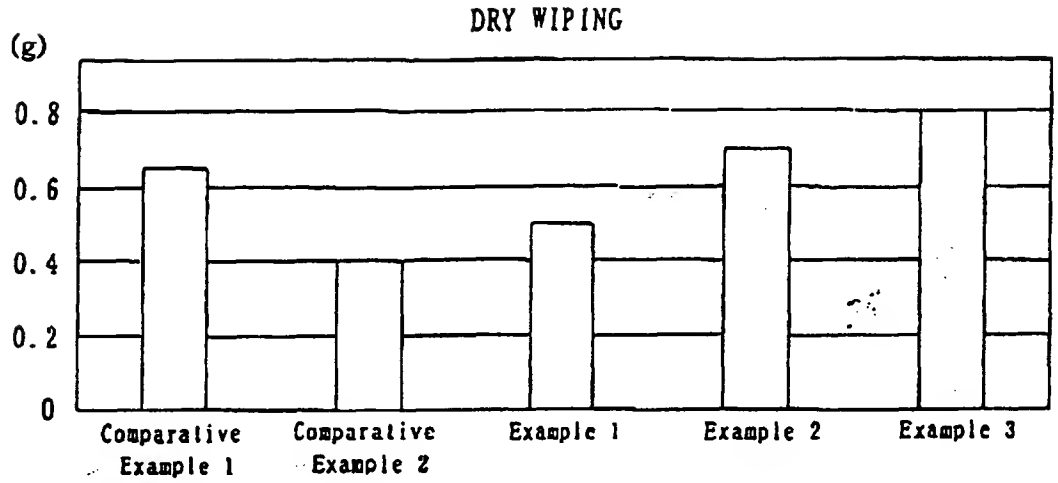


Fig. 7

Fig. 8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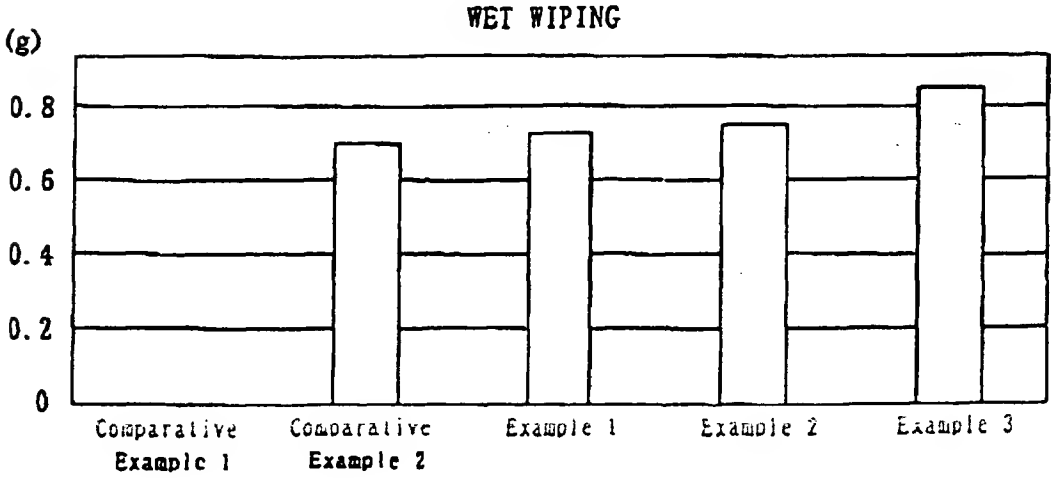
Comparative Example 1
Comparative Example 2
Example 1
Example 2
Example 3

Fig. 9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Comparative Example 1
Comparative Example 2
Example 1
Example 2
Example 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 3831

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 August 1999	Barathe, R

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